

Fig. 1

Hpv11-e1	1	60
Hpv6a-e1	MADDSGTENEGSGCTGWMVEAIVEHTGTQISEDEEEVEDSGYDMVDFIDDRHITQNS	
6b-e1	MADDSGTENEGSGCTGWMVEAIVQHPTGTQISDDEEEVEDSGYDMVDFIDDSNITHNS	
	MADDSGTENEGSGCTGWMVEAIVQHPTGTQISDDEEEVEDSGYDMVDFIDDSNITHNS	
Hpv11-e1	61	120
Hpv6a-e1	VEAQALFNRQEADAHYATVQDLKRKYLGSVPISNVANAVESEISPRLDAIKLTTQPK	
6b-e1	LEAQALFNRQEADTHYATVQDLKRKYLGSVPINTIAEAVESEISPRLDAIKLTRQPK	
	LEAQALFNRQEADTHYATVQDLKRKYLGSVPINTIAEAVESEISPRLDAIKLTRQPK	
Hpv11-e1	181	180
Hpv6a-e1	KVKRRLFETRELTDGYGYSEVEA..ATQVEKHGDPENGGDGQERDTGRDIEGEGVEHRE	
6b-e1	KVKRRLFQTRELTDGYGYSEVEAGTGTQVEKHGPENGGDGQEKDTGRDIEG..EEHTE	
	KVKRRLFQTRELTDGYGYSEVEAGTGTQVEKHGPENGGDGQEKDTGRDIEG..EEHTE	
Hpv11-e1	241	240
Hpv6a-e1	AEAVDDSTREHADTSGILELLKCKDIRSTLHGKFKDCFGGLSFVDLIRPKSDRTTCADWV	
6b-e1	AEAPTNVREHAGTAGILELLKCKDLRAALLGKFKECFGGLSFIDLIRPKSDKTTCLDWV	
	AEAPTNVREHAGTAGILELLKCKDLRAALLGKFKECFGGLSFIDLIRPKSDKTTCLDWV	
Hpv11-e1	301	300
Hpv6a-e1	VAGFGIHHSIADAFQKLIEPLSLYAHIQWLNAWMVLLVLIRFKVNKSRCTVARTLGLT	
6b-e1	VAGFGIHHSISEAFQKLIEPLSLYAHIQWLNAWMVLLVLRFKVNKSRTVARTLATL	
	VAGFGIHHSISEAFQKLIEPLSLYAHIQWLNAWMVLLVLRFKVNKSRTVARTLATL	
Hpv11-e1	361	360
Hpv6a-e1	LNIPENHMLIEPPKIQSGVRALYWFRTGISNASTVIGEAPEWITRQTVIEHSLADSFKL	
6b-e1	LNIPDNQMLIEPPKIQSGVAALYWFRTGISNASTVIGEAPEWITRQTVIEHGLADSFKL	
	LNIPENQMLIEPPKIQSGVAALYWFRTGISNASTVIGEAPEWITRQTVIEHGLADSFKL	
Hpv11-e1	421	420
Hpv6a-e1	TEMVQWAYDNDICEESEIAFEYAQRGDFDSNARAFLNSNMQAKYVKDCAIMCRHYKHAEM	
6b-e1	TEMVQWAYDNDICEESEIAFEYAQRGDFDSNARAFLNSNMQAKYVKDCATMCRHYKHAEM	
	TEMVQWAYDNDICEESEIAFEYAQRGDFDSNARAFLNSNMQAKYVKDCATMCRHYKHAEM	
Hpv11-e1	481	480
Hpv6a-e1	KKMSIKQWIKYRGTKVDSGNWKPIVQFLRHQNIEFIPFLSKLKLWLHGTPKKNCIAIVG	
6b-e1	RKMSIKQWIKHRGSKIEGTGNWKPIVQFLRHQNIEFIPFLSKFKLWLHGTPKKNCIAIVG	
	RKMSIKQWIKHRGSKIEGTGNWKPIVQFLRHQNIEFIPFLTKFLWLHGTPKKNCIAIVG	
Hpv11-e1	541	540
Hpv6a-e1	PPDTGKSCFCMSLIKFLGGTVISYVNCSHFWLQPLTDALKVALLDDATQPCWTYMDTYMR	
6b-e1	PPDTGKSYFCMSLISFLGGTVISHVNSSHFWLQPLVDAKVALLDDATQPCWIYMDTYMR	
	PPDTGKSYFCMSLISFLGGTVISHVNSSHFWLQPLVDAKVALLDDATQPCWIYMDTYMR	
Hpv11-e1	541	600
Hpv6a-e1	NLLDGNPMSIDRKHRLTLLIKCPPLLVTNSNIDISKEEKYKYLHSRVTTFPNPFPFDNR	
6b-e1	NLLDGNPMSIDRKHKALTLLIKCPPLLVTNSNIDITKEEKYKYLHTRVTTFTFPNPFPFDNR	
	NLLDGNPMSIDRKHKALTLLIKCPPLLVTNSNIDITKEDKYKYLHTRVTTFTFPNPFPFDNR	
Hpv11-e1	601	651
Hpv6a-e1	GNavyelsdanwkcfkerlssssldiedseeedgsnsqafrcvpgsvvrtl [SEQ.ID NO.1]	
6b-e1	GNavyelsnanwkcfkerlssssldiqdseeedgsnsqafrcvpgtvvrtl [SEQ.ID NO.2]	
	GNavyelsntnwkcfkerlssssldiqdseeedgsnsqafrcvpgtvvrtl [SEQ.ID NO.3]	

Fig. 2

6b-e1	1	60
6b-e1 mut	MADDSGTENEGSGCTGWFMVEAIVQHPTGTQISDDEEVEDSGYDMVDFIDDSNITHNS	
6b-e1	61	120
6b-e1 mut	LEAQALFNRQEADTHYATVQDLKRKYLGSPYVSPINTIAEAVESEISPRLDAIKLTRQPK	
6b-e1	121	180
6b-e1 mut	KVKRRLFQTRELTDGYGYSEVEAGTGTQVEKHGVPENGDGQEKTGRDIEGEEHTEAE	
6b-e1	181	240
6b-e1 mut	APTNCSVREHAGTAGILELLKCKDLRAALLGKFKECFGGLSFIDLIRPFKSDKTTCLDWVVA	
6b-e1	241	300
6b-e1 mut	GFGIHHSISEAFQKLIPEPLSLYAHIQWLNAWGMVLLVLLRFKVNKSRSVARTLATLLN	
6b-e1	301	360
6b-e1 mut	IPENQMLIEPPKIQSGVAALYWFRTGISNASTVIGEAPEWITRQTVIEHGLADSQFKLTE	
6b-e1	361	420
6b-e1 mut	MVQWAYDNDICEESEIAFEYAQRGDFDSNARAFLNSNMQAKYVKDCATMCRHYKHAEMRK	
6b-e1	421	480
6b-e1 mut	MSIKQWIHKRGSKIEGTGNWKPIVQFLRHQNIEFIPFLTKFKLWLHGTPKNCIAIVGPP	
6b-e1	481	540
6b-e1 mut	DTGKSYFCMSLISFLGGTVISHVNSSSHFWLQPLVDAKVALDDATQPCWIYMDTYMRNL	
6b-e1	541	600
6b-e1 mut	LDGNPMSIDRKHKALTЛИКППЛЛВTSNIDITKEDKYKYLHTRVTTFTFPNPFPFDRNGN	
6b-e1	601	649
6b-e1 mut	AVYELSNTNWKCFFERLSSSLDIQDSEDEEDGSNSQAFRCVPGTVVRTL [SEQ.ID NO.4]	
6b-e1	601	649
6b-e1 mut	AVYELSNTNWKCFFERLSSSLDIQDSEDEEDGSNSQAFRCVPGTVVRTL [SEQ.ID NO.5]	

Fig. 3

	1	60
Hpv-11e2	MEAIAKRLDACQDQLLELYEENSIDIHKHIMHWKCIRLESVLLHKAKQMGLSHIGLQVV	
Hpv6a-e2	MEAIAKRLDACQEQLLELYEENSTDLNKHVLHWKCMRHESVLLYKAKQMGLSHIGMQVV	
Hpv6b-e2	MEAIAKRLDACQEQLLELYEENSTDLHKHVLHWKCMRHESVLLYKAKQMGLSHIGMQVV	
	61	120
Hpv-11e2	PLTVSETKGHNIAEMQMHL	
Hpv6a-e2	ESI	
Hpv6b-e2	AKTQYGVEPWTLQDTSYEMWLTPPKRCFKKQGNTVEVK	
	121	180
Hpv-11e2	PLKVSEAKGHNAIEMQMHL	
Hpv6a-e2	ESI	
Hpv6b-e2	LLKTEYSMEPWTLQETSYEMWQTPPKRCFKKRGKTVEVK	
	181	240
Hpv-11e2	PLKVSEAKGHNAIEMQMHL	
Hpv6a-e2	ESI	
Hpv6b-e2	LLRTEYSMEPWTLQETSYEMWQTPPKRCFKKRGKTVEVK	
	241	300
Hpv-11e2	FDGCEDNVMEYVVWTHIYLQDNDSWVKVTSSVDAKGIYYTCGQFKTYYVN	
Hpv6a-e2	FNKEAQKYGS	
Hpv6b-e2	FDGCANNTMDYVVWTDVYVQDTSWVKVHSMVDAKGIYYTCGQFKTYYVN	
		FNFKTYYVN
		FVKEAEKYGS
	361	369
Hpv-11e2	VGFMSLHLL [SEQ. ID NO. 6]	
Hpv6a-e2	LGFMSLHLL [SEQ. ID NO. 7]	
Hpv6b-e2	LGFMSLHLL [SEQ. ID NO. 8]	

Fig. 4a

Hpv-11e2-comut	1	60
Hpv-11e2-mut	MEAIAKRLLDACQDQLLELYEENSIDIHKHIMHWKCIRLESVLLHKAKQMGLSHIGLQVVP	
Hpv-11e2-wt	MEAIAKRLLDACQDQLLELYEENSIDIHKHIMHWKCIRLESVLLHKAKQMGLSHIGLQVVP	
Hpv-11e2-comut	61	120
Hpv-11e2-mut	PLTVSETKGHNIAEMQMHLESLAKTQYGVEPWTLQDTSYEMWLTTPKRCEAKQGNTVEVK	
Hpv-11e2-wt	PLTVSETKGHNIAEMQMHLESLAKTQYGVEPWTLQDTSYEMWLTTPKRCEAKQGNTVEVK	
Hpv-11e2-comut	121	180
Hpv-11e2-mut	FDGCEDNVMEYVVWTHIYLQDNDWSVKVTSSVDAKGIYYTCGQFKTYYVNFNKEAQKYGS	
Hpv-11e2-wt	FDGCEDNVMEYVVWTHIYLQDNDWSVKVTSSVDAKGIYYTCGQFKTYYVNFNKEAQKYGS	
Hpv-11e2-comut	181	240
Hpv-11e2-mut	TNHWEVCYGSTVICSPASVSSTVREVSIAEPTTYTPAQTTAPTVSACTTEDGVSAPPRKR	
Hpv-11e2-wt	TNHWEVCYGSTVICSPASVSSTVREVSIAEPTTYTPAQTTAPTVSACTTEDGVSAPPRKR	
Hpv-11e2-comut	241	300
Hpv-11e2-mut	ARGPSTNNTLCVANIRSDSTINNIVTDYNKHQRRNNCHSAATPIVQLQGDSNCLKCFR	
Hpv-11e2-wt	ARGPSTNNTLCVANIRSDSTINNIVTDYNKHQRRNNCHSAATPIVQLQGDSNCLKCFR	
Hpv-11e2-comut	301	360
Hpv-11e2-mut	YRLNDKYKHLFELASSTWHWASPEAPHKNAIVTLYSSEEQRQQFLNSVKIPPTIRHKVG	
Hpv-11e2-wt	YRLNDKYKHLFELASSTWHWASPEAPHKNAIVTLYSSEEQRQQFLNSVKIPPTIRHKVG	
Hpv-11e2-comut	361	367
Hpv-11e2-mut	FMSLHLL [SEQ. ID NO. 9]	
Hpv-11e2-wt	FMSLHLL [SEQ. ID NO. 10]	
Hpv-11e2-wt	FMSLHLL [SEQ. ID NO. 11]	

Fig. 4b

	1	60
Hpv-6be2-wt	MEAIAKRLDACQEQLLELYEENSTDHKHVLHWKCMRHESVLLYKAKQMGLSHIGMQVVP	
Hpv-6be2-mut	MEAIAKRLDACQEQLLELYEENSTDHKHVLHWKCMRHESVLLYKAKQMGLSHIGMQVVP	
	61	120
Hpv-6be2-wt	PLKVSEAKGHNAIEMQMHL ESLLRTEYSMEPWT LQETSYEMWQTPPKRCF KKRGKTVEVK	
Hpv-6be2-mut	PLKVSEAKGHNAIEMQMHL ESLLRTEYSMEPWT LQETSYEMWQTPPKRCF AKRGKTVEVK	
	121	180
Hpv-6be2-wt	FDGCANNTMDYVVWTDVYVQDND TWVKVHSMVDAKGIYYTCGQF KTYYVNFVKEAEKYGS	
Hpv-6be2-mut	FDGCANNTMDYVVWTDVYVQDND TWVKVHSMVDAKGIYYTCGQF KTYYVNFVKEAEKYGS	
	181	240
Hpv-6be2-wt	TKHWEVCYGSTVICSPAS VSSTTQEVSIPESTTY TPAQTSTL.VSSSTK EDAVQTPPRKR	
Hpv-6be2-mut	TKHWEVCYGSTVICSPAS VSSTTQEVSIPESTTY TPAQTSTL.VSSSTK EDAVQTPPRKR	
	241	300
Hpv-6be2-wt	ARGVQQSPCNALCVA HIGPVDSGNHNLITNN HDQHQRNNNSNSAT PIVQFQGESNCLKC	
Hpv-6be2-mut	ARGVQQSPCNALCVA HIGPVDSGNHNLITNN HDQHQRNNNSNSAT PIVQFQGESNCLKC	
	301	360
Hpv-6be2-wt	FRYRLNDRHRHLFDL ISSTWHWASSKAPH KHAI VT VTD SEE QRQQFL DV V KIP PT ISHK	
Hpv-6be2-mut	FRYRLNDRHRHLFDL ISSTWHWASSKAPH KHAI VT VTD SEE QRQQFL DV V KIP PT ISHK	
	361	369
Hpv-6be2-wt	LGFM SLHLL [SEQ. ID NO. 12]	
Hpv-6be2-mut	LGFM SLHLL [SEQ. ID NO. 13]	

Fig. 5a

HPV6bel-comut	1	60
	GC GGCCGCCATGGCAGACGATTCCGGTACTGAGAACGAAGGTTCTGGTTGTACCGGTTGG	
HPV6bel-comut	61	120
	TTCATGGTTGAAGCAATCGTTAGCATCCGACTGGTACCCAGATCTCCGATGACGAAGAC	
HPV6bel-comut	121	180
	GAAGAAAGTTGAAGATTCTGGTTACGACATGGTTGACTTCATCGATGACTCCAACATCACT	
HPV6bel-comut	181	240
	CATAACTCTCTGGAAGCACAGGCTCTGTTAACGCCAGGAAGCTGATACCCATTACGCT	
HPV6bel-comut	241	300
	ACTGTTCAGGACCTGGGAGGCAAATATCTGGGCTCTCCGTACGTTCCCCGATCAACACT	
HPV6bel-comut	301	360
	ATCGCAGAACAGCAGTTGAGTCTGAAATCTCCCGCGCTGGACGCTATCAAACACTGACTCGT	
HPV6bel-comut	361	420
	CAGCCGAAGAACGGTTAACGTCGTCTGTTCCAGACTCGTGAACGACCGACTCCGGTTAC	
HPV6bel-comut	421	480
	GGTTATAGCGAAGTTGAGGCTGGCACCGGCACCCAGGTTGAAAAACACGGTGTACCGGAA	
HPV6bel-comut	481	540
	AACGGCGGCGACGGTCAGGAAAAGGACACCGGCCGACATCGAGGGTGAGGAACACACC	
HPV6bel-comut	541	600
	GAAGCTGAAGCTCCGACTAACTCTGTTCTGAAACACGCAGGTACTGCGGGTATCCTGGAA	
HPV6bel-comut	601	660
	CTGCTGAAATGCAAAGACCTGCGCGCGCTCTGCTGGCAAATTCAAAGAATGCTTCGGC	
HPV6bel-comut	661	720
	CTGTCTTCATTGACCTGATCCGTCCGTTAAGTCTGACAAAACACCTGTCTGGACTGG	
HPV6bel-comut	721	780
	GTTGTAGCAGGCTTCGGCATCCACACTCTATCTGAAGCATTCCAGAAACTGATCGAG	
HPV6bel-comut	781	840
	CCGCTGTCTCTGTACGCGCACATCCAGTGGCTGACTAACGCTGGGTATGGTTCTGCTG	
HPV6bel-comut	841	900
	GTACTGCTGCGTTAAAGTAAACAAATCTCGTTCCACTGTTGCTCGTACTCTGGCTACC	
HPV6bel-comut	901	960
	CTGCTGAACATCCGGAGAACCGAGATGCTGATCGAACCGCCGAAAATCCAGTCTGGTGT	
HPV6bel-comut	961	1020
	GCTGCACTGTACTGGTTCTGACTGGCATCTCTAACGCTAGCACTGTTATCGGTGAAGCA	
HPV6bel-comut	1021	1080
	CCGGAATGGATCACTCGTCAGACCGTTATCGAACACGGTCTGGCAGATTCTCAGTTCAA	
HPV6bel-comut	1081	1140
	CTGACTGAAATGGTTAGTGGGCATACGACAACGACATCTGCGAGGAATCTGAAATTGCG	

Fig. 5b

1141 1200
HPV6bel-comut TTCAATACGCTCAGCGTGGCGACTTCGACTCCAACGCTCGCTTCCCTGAACAGCAAC
1201 1260
HPV6bel-comut ATGCAGGCTAAATACGTAAAAGACTGCGCTACCATGTGCCGTCACTACAAACACGCGGAA
1261 1320
HPV6bel-comut ATGCGTAAAATGTCTATCAAACAGTGGATCAAGCACCGCGTTCTAAAATCGAAGGTACC
1321 1380
HPV6bel-comut GGTAACTGGAAACCGATCGTTAGTCAGTGCCTGCCATCAGAACATCGAATTCATCCGTTTC
1381 1440
HPV6bel-comut CTGACCAAATTCAAGCTGTGGCTGCACGGTACCCGAAAAAAAAC TGCACTCGCTATCGTA
1441 1500
HPV6bel-comut GGTCCACCGGACACTGACAAGTCTTACTTCTGTATGCCCTGATCTTTCTGGCGGC
1501 1560
HPV6bel-comut ACTGTAATCTCTCACGTTAACTCTCCTCCATTCTGGCTGCAGCCACTGGTAGACGCG
1561 1620
HPV6bel-comut AAAGTAGCTCTGCTGGACGACGCGACCCAGCCGTGCTGGATCTACATGGATACTTACATG
1621 1680
HPV6bel-comut CGCAACCTGCTGGACGGTAACCGATGTCTATCGACCGTAAACACAAAGCGCTGACTCTG
1681 1740
HPV6bel-comut ATCAAGTCCCCGCCGCTGCTGGTAACCTCTAACATCGACATCACCAAGGAAGATAAAATC
1741 1800
HPV6bel-comut AAGTACCTGCATACCCGTGTTACTACCTTACTTCCGAACCGTTCCGTTGATCGT
1801 1860
HPV6bel-comut AACGGTAACGCTGTTACGAACACTGCCAACACTAACACTGGAAATGCTCTCGAGCGTCTG
1861 1920
HPV6bel-comut TCTTCCTCCCTGGACATCCAGGACTCTGAAGATGAAGAAGATGGTCTAACACTCAGGCT
1921 1968
HPV6bel-comut TTCCGTTGTGTTCCGGGTACTGTTGTTGACTCTGTGAGGATCC''. [SEQ.ID NO. 14]

Fig. 6

1 Hpv11e2-comut ' ' GCGGCCGCATGGAAGCCATCGCGAAGAGGCTCGACGCCCTGCCAGGACCAGCTGCTCG
 60
 61 Hpv11e2-comut AGCTGTACGAGGAGAACAGCATTGACATCCATAAGCACATCATGCACTGGAAGTGCATT
 120
 121 Hpv11e2-comut GCCTGGAGAGCGTGCTGTTGCACAAGGCCAAGCAGATGGCCTGCCCCACATAGGCCTTC
 180
 181 Hpv11e2-comut AGGTGGTCCCCCTCTGACCGTGTCAAGAGACAAAGGCCATAACGCAATCGAGATGCAGA
 240
 241 Hpv11e2-comut TGCACCTCGAGTCGCTGGCGAAAACACAGTACGGCGTGGAGCCATGGACCCCTGCAGGACA
 300
 301 Hpv11e2-comut CCTCGTACGAAATGTGGCTGACCCCACCTAACGCGATGCTCGCCAAACAGGGCAACACAG
 360
 361 Hpv11e2-comut TGGAGGTGAAGTTCGACGGCTGTGAGGATAACGTTATGGAGTATGTCGTGACGCACA
 420
 421 Hpv11e2-comut TCTATCTGCAGGACAACGACAGTTGGGTGAAGGTGACCAGCTCCGTGGACGCGAAGGGCA
 480
 481 Hpv11e2-comut TCTACTATACCTGTGGCAGTTAAAACCTACTATGTGAACTTCAACAAAGAGGCCAAA
 540
 541 Hpv11e2-comut AGTATGGCTCCACCAACCACGGAGGTCTGCTATGGGAGCACGGTGATTGCTCTCCCG
 600
 601 Hpv11e2-comut CCAGCGTGTCTAGCACTGTGCGCGAGGTGAGCATTGCCGAGCCACGTACACCCCTG
 660
 661 Hpv11e2-comut CCCAGACGACCGCTCCGACCGTGTCTGCTTACTACCGAGGACGGCGTGAGCGCTCCAC
 720
 721 Hpv11e2-comut CCAGGAAGCGTGCAGGGGCCAACGACCAACACCCCTGTGTGGCGAACATTGCGA
 780
 781 Hpv11e2-comut GCGTCGACAGTACCATCAATAACATCGTACGGATAACTATAACAAGCACCAGAGCGTA
 840
 841 Hpv11e2-comut ACAACTGTCACTCTGCCGAAACCCCCATCGTGCAGCTCCAGGGAGACAGCAATTGCCTTA
 900
 901 Hpv11e2-comut AGTGCTTCCGCTATCGCCTAACGACAAGTACAAGCACCTCTTGAGCTGCCCTCGTCGA
 960
 961 Hpv11e2-comut CGTGGCACTGGGCCTCACCGAGGCACCTCACAGAACGCCATCGTCACTCTCACTTACT
 1020
 1021 Hpv11e2-comut CCAGTGAGGAGCAGAGACAGCAGTTCTGAACAGCGTGAAGATCCCACCGACGATCCGTC
 1080
 1081 Hpv11e2-comut ATAAGGTCGGCTTCATGTCAGTCATGCCATCTCCTGTGAGGATCC' ' [SEQ. ID NO. 15]

Fig. 7

WRG7313plc

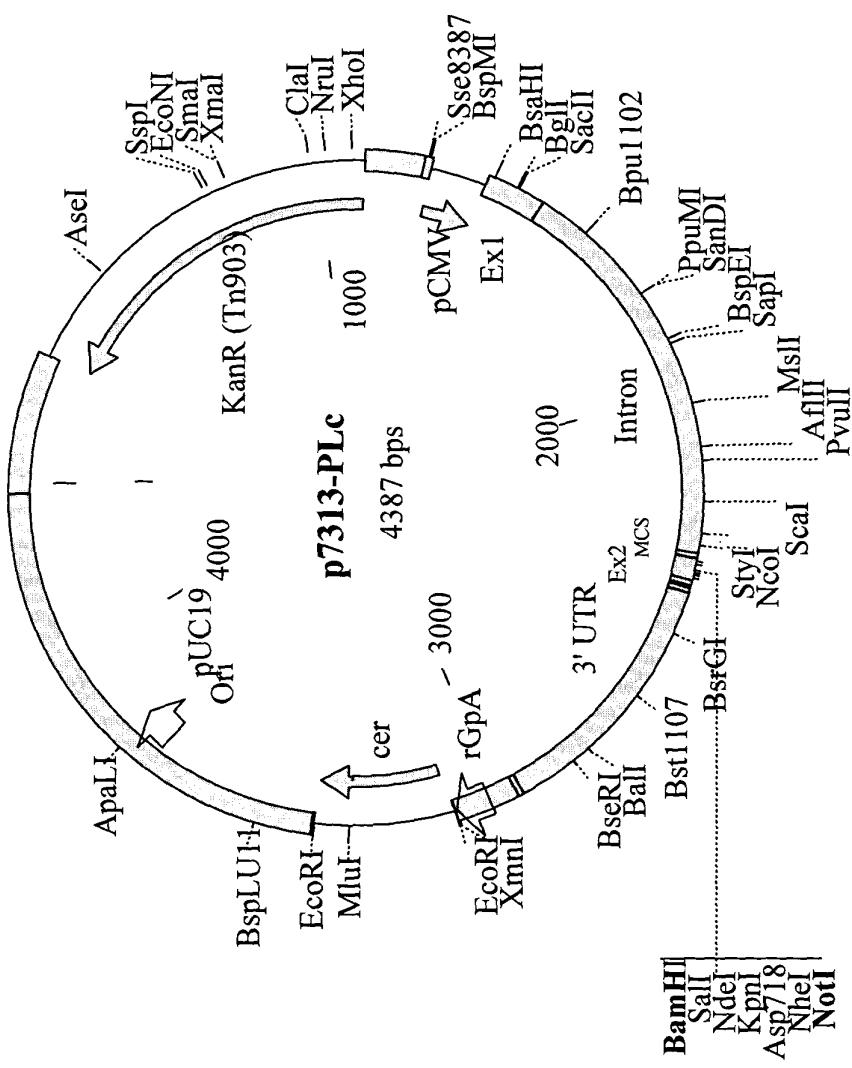
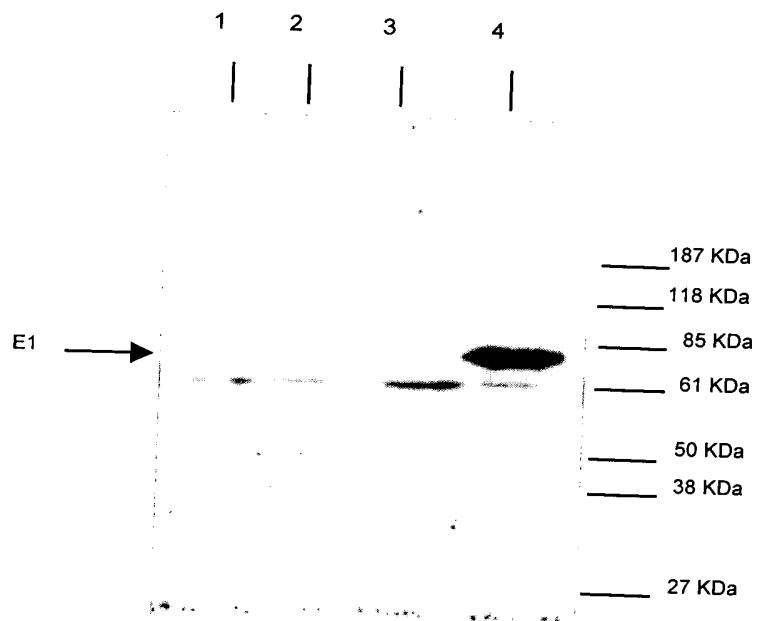


Fig. 8



Key :

- 1- 293T cell lysate control
- 2- p7313PLc vector control
- 3- p6bE1 w/t
- 4- p6bE1 c/o

Fig. 9

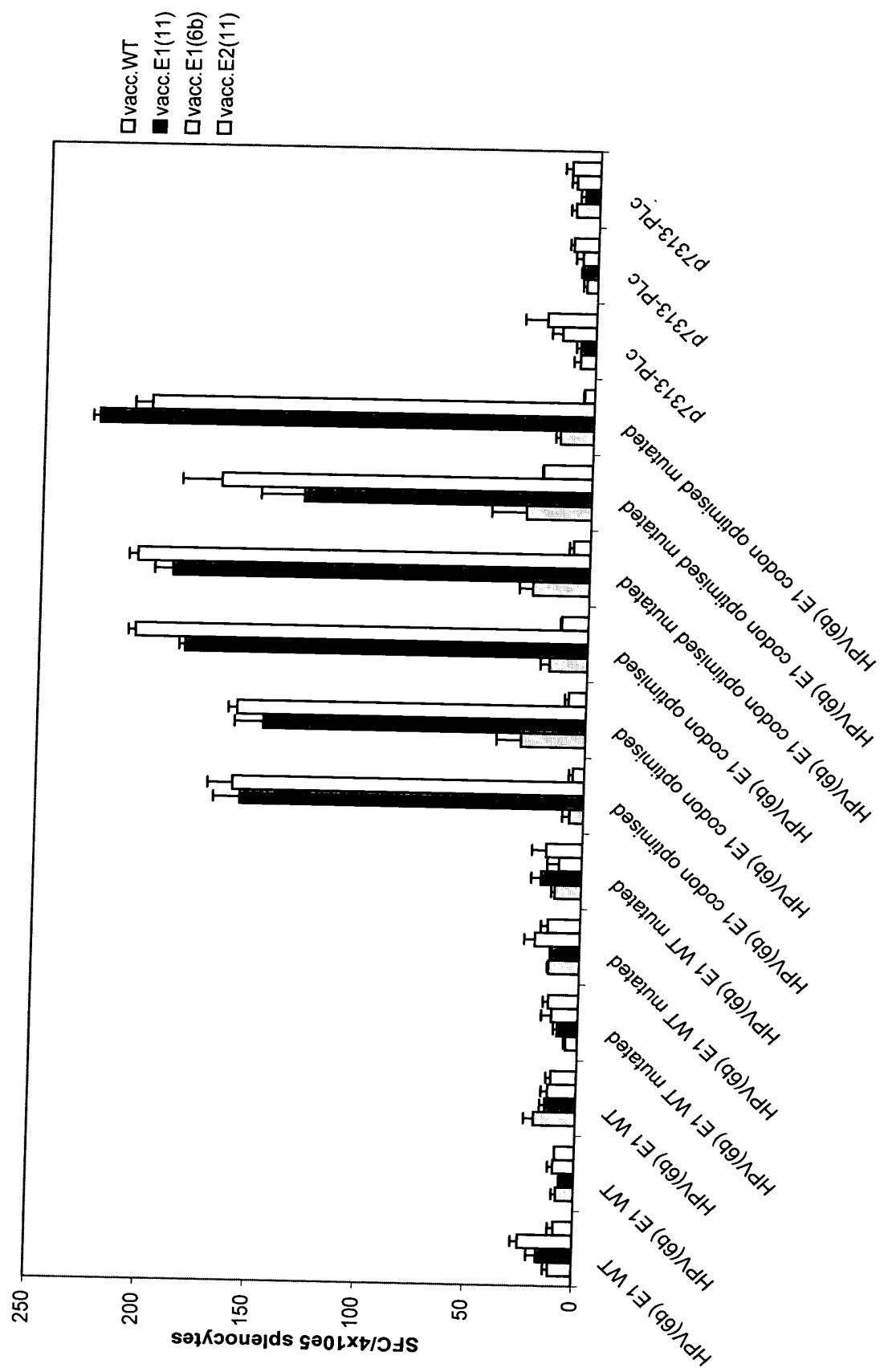
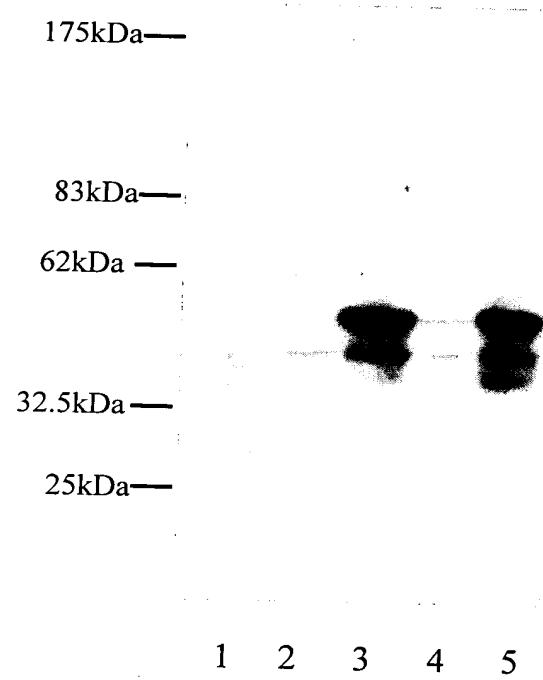


Fig. 10



1	p7313PLc
2	p6bE2 w/t
3	p6bE2 c/o
4	p6bE2 w/t mutated
5	p6bE2 c/o mutated

Fig. 11

Codon-optimised COPV E1 protects against Disease

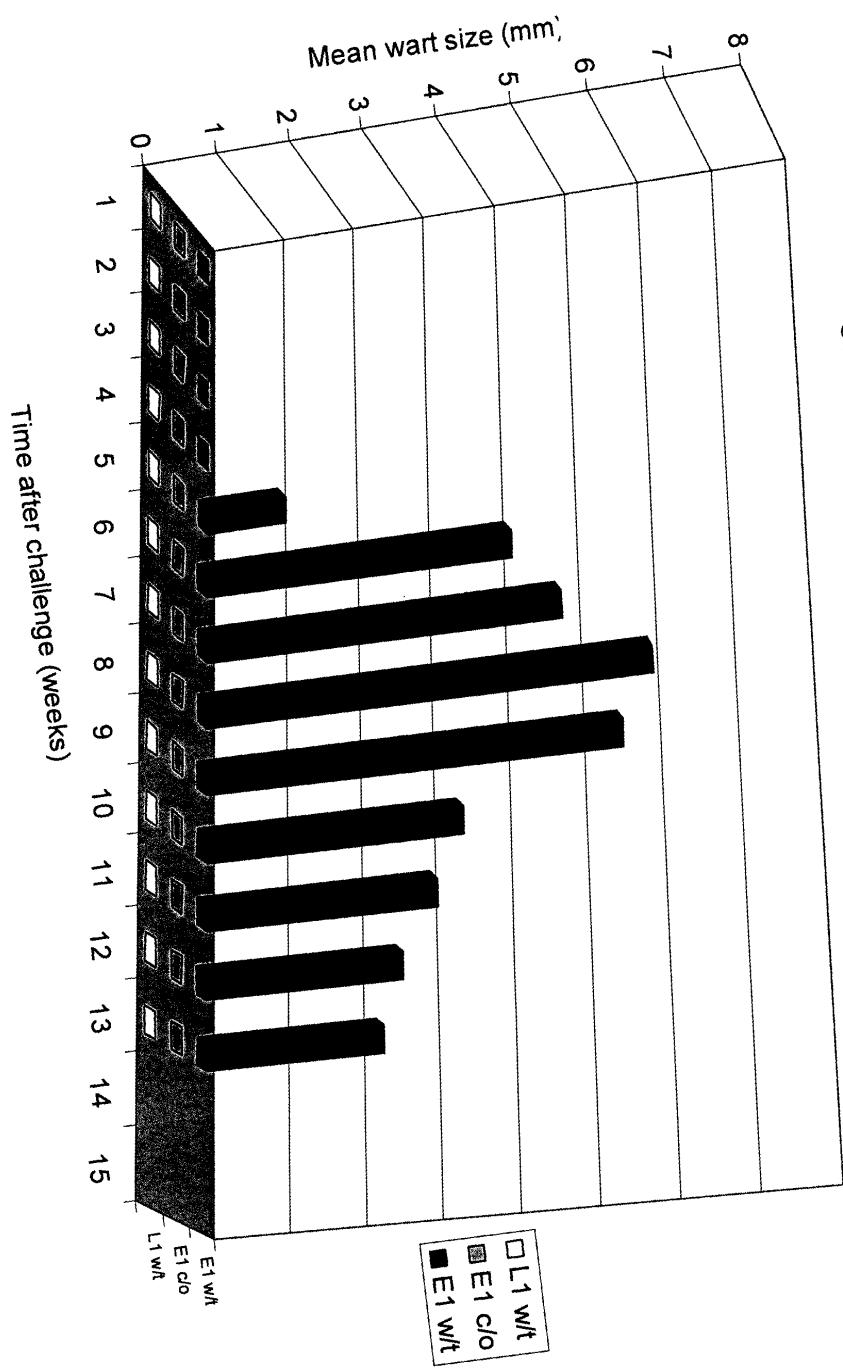


Fig. 12

Codon-optimisation of the COPV E1 gene significantly improves protein expression.

